

Title 122 - NEBRASKA DEPARTMENT OF ENVIRONMENTAL QUALITY

Chapter 17 - CONSTRUCTION AND SITING REQUIREMENTS; CLASS I, III, and V INJECTION WELLS AND MINERAL PRODUCTION WELLS

001 General Requirements

Existing wells shall achieve compliance with requirements set forth in Section 002 of this Chapter according to a compliance schedule established as a permit condition. New wells shall be in compliance with this Chapter prior to commencing injection operations and contingent upon final Department approval of construction design. Changes in construction plans during construction may be approved by the Director as minor modifications (Chapter 30 of this Title). No such changes may be physically incorporated into construction of the well prior to approval of the modification by the Director. All wells constructed into ground water, must be constructed by a licensed/certified water well contractor as defined by Nebraska Health and Human Services System, Water Well Standards and Licensing Act, Article 46.

002 Specific Requirements for Class I Injection Wells

002.01 All Class I well designs shall be submitted by a professional engineer.

002.02 All Class I wells shall be sited in such a fashion that they inject into a formation which is beneath the lowermost formation containing an underground source of drinking water that is located within one quarter mile of the injection well bore.

002.03 All Class I wells shall be cased and cemented to prevent the movement of fluids into or between underground sources of drinking water. The casing and cement used in the construction of each newly drilled well shall be designed for the life expectancy of the well. In determining and specifying casing and cementing requirements the following factors shall be considered:

002.03A. Depth to the injection zone;

002.03B. Injection pressure, external pressure, internal pressure, and axial loading;

002.03C. Hole size;

002.03D. Size and grade of all casing strings (wall thickness, diameter, nominal weight, length, joint specification, and construction material);

002.03E. Corrosiveness of injected fluid, formation fluids, and temperatures;

002.03F. Lithology of injection and confining intervals; and

002.03G. Type and grade of cement.

002.04 All Class I injection wells shall inject fluids through tubing with a packer set immediately above the injection zone, or tubing with an approved fluid seal as an alternative. The tubing, packer, and fluid seal shall be designed for the expected service.

002.04A. The use of other alternatives to a packer may be allowed with the written approval of the Director. To obtain approval, the operator shall submit a written request to the Director, which shall set forth the proposed alternative and all technical data supporting its use. The Director shall approve the request if the alternative method will reliably provide a comparable level of protection to underground sources of drinking water. The Director may approve an alternative method solely for an individual well or for general use.

002.04B. In determining and specifying requirements for tubing, packer, or alternatives the following factors shall be considered:

002.04B1 Depth of setting;

002.04B2 Characteristics of injection fluid (chemical content, corrosiveness, and density);

002.04B3 Injection pressure;

002.04B4 Annular pressure;

002.04B5 Temperature and volume of injected fluid;

002.04B6 Rate of fluid injection; and

002.04B7 Size, composition and specifications of casing.

002.04C Each Class I well utilizing a positive displacement pump shall be equipped with both high and low pressure safety switches which will shut down the pump in case of pressure increase over the authorized pressure or sudden pressure loss.

002.04D Appropriate logs and other tests shall be conducted during the drilling and construction of new Class I wells. A descriptive report interpreting the results of such logs and tests shall be prepared by a qualified log analyst and submitted to the Director. At a minimum, such logs and tests shall include:

002.04D1. Deviation checks on all holes constructed by first drilling a pilot hole, and then enlarging the pilot hole by reaming or another method. Such checks shall be at sufficiently frequent intervals to assure that vertical avenues for fluid migration in the form of diverging holes are not created during drilling;

002.04D2. Such other logs and tests as may be needed after taking into account the availability of similar data in the area of the drilling site, the construction plan, and the need for additional information that may arise from time to time as the construction of the well progresses. In determining which logs and tests shall be required, the following logs shall be considered for use in the following situations:

002.04D2(a) For surface casing intended to protect underground sources of drinking water:

002.04D2(a)(1) Resistivity, spontaneous potential, and caliper logs before the casing is installed; and

002.04D2(a)(2) A cement bond, temperature, or density log after the casing is set and cemented.

002.04D2(b) For intermediate and long strings of casing intended to facilitate injection:

002.04D2(b)(1) Resistivity, spontaneous potential, porosity, and gamma ray logs before the casing is installed;

002.04D2(b)(2)) Fracture finder logs; and

002.04D2(b)(3) A cement bond, temperature, or density log after the casing is set and cemented.

002.04E At a minimum, the following information concerning the injection formation shall be determined or calculated for new Class I wells:

002.04E1. Fluid pressure;

002.04E2. Temperature;

002.04E3. Fracture pressure;

002.04E4. Other physical and chemical characteristics of the injection zone; and

002.04E5. Physical and chemical characteristics of the formation fluids.

003 Specific Requirements for Class III Injection Wells

003.01 All Class III well designs shall be submitted by a professional engineer.

003.02 All new Class III wells shall be cased and cemented to prevent the migration of fluids into or between underground sources of drinking water. The casing and cement used in construction of each newly drilled well shall be designed for the life expectancy of the well. In determining and specifying casing and cementing requirements, the following factors shall be considered:

003.02A. Depth to the injection zone;

003.02B. Injection pressure, external pressure, internal pressure, axial loading, etc;

003.02C. Hole size;

003.02D. Size and grade of all casing strings (wall thickness, diameter, nominal

weight, length, joint specification, and construction material);

003.02E. Corrosiveness of injected fluids and formation fluids;

003.02F. Lithology of injection and confining zones; and

003.02G. Type and grade of cement.

003.03 Each Class III well or group of wells utilizing a positive displacement pump shall be equipped with both high and low pressure safety switches which will shut down the pump in case of pressure increase over the authorized pressure or sudden pressure loss.

003.04 Appropriate logs and other tests shall be conducted during the drilling and construction of new Class III wells. A descriptive report interpreting the results of such logs and tests shall be prepared by a qualified log analyst and submitted to the Director. The logs and tests appropriate to each type of Class III well shall be determined based on the intended function, depth, construction and other characteristics of the well, availability of similar data in the area of the drilling site and the need for additional information that may arise from time to time as the construction of the well progresses. At a minimum, such logs and tests shall include deviation checks conducted on all holes where pilot holes and reaming are used, at sufficiently frequent intervals to assure that vertical avenues for fluid migration in the form of diverging holes are not created during drilling.

003.05 Where the injection zone is a water bearing formation, the following information concerning the injection zone shall be determined or calculated for new Class III wells:

003.05A. Fluid pressure;

003.05B. Temperature;

003.05C. Fracture pressure;

003.05D. Other physical and chemical characteristics of the injection zone;

003.05E. Physical and chemical characteristics of the formation fluids; and

003.05F. Compatibility of injected fluids with formation fluids.

003.06 Where the injection formation is not a water bearing formation, the information in Section 002.02D3 of this Chapter must be submitted.

003.07 Where injection is into a formation which contains water with less than 10,000 mg/l TDS, monitoring wells shall be completed into the injection zone and into any underground sources of drinking water above the injection zone which could be affected by the mining operation. These wells shall be located in such a fashion as to detect any migration of injection fluids, process by-products, or formation fluids outside the mining area or zone. If the operation may be affected by subsidence or catastrophic collapse, the monitoring wells shall be located so that they will not be physically affected.

003.08 Where injection is into a formation which does not contain water with less than

10,000 mg/l TDS, no monitoring wells are necessary in the injection stratum.

003.09 Where the injection wells penetrate an USDW in an area subject to subsidence or catastrophic collapse an adequate number of monitoring wells shall be completed into the USDW to detect any movement of injected fluids, process by-products or formation fluids into the USDW. The monitoring wells shall be located outside the physical influence of the subsidence or catastrophic collapse.

003.10 In determining the number, location, construction and frequency of monitoring of the monitoring wells the following criteria shall be considered:

003.10A. The population relying on the USDW affected or potentially affected by the injection operation;

003.10B. The proximity of the injection operation to points of withdrawal of drinking water;

003.10C. The local geology and hydrology;

003.10D. The operating pressures and whether a negative pressure gradient is being maintained;

003.10E. The toxicity and volume of the injected fluid, the formation water, and the process by-products; and

003.10F. The injection well density.

004 Specific Requirements for Mineral Production Wells

004.01 All mineral production well designs shall be submitted by a professional engineer.

004.02 All new mineral production wells shall be cased and cemented to prevent the migration of fluids into or between underground sources of drinking water. The casing and cement used in construction of each newly drilled well shall be designed for the life expectancy of the well. In determining and specifying casing and cementing requirements, the following factors shall be considered:

004.02A. Depth to the production zone;

004.02B. External pressure, internal pressure, axial loading, etc.;

004.02C. Hole size;

004.02D. Size and grade of all casing strings (wall thickness, diameter, nominal weight, length, joint specification, and construction material);

004.02E. Corrosiveness of production fluids and formation fluids or combination thereof;

004.02F. Lithology of production and confining zones; and

004.02G. Type and grade of cement.

004.03 Each mineral production well or group of wells utilizing a positive displacement pump shall be equipped with both high and low safety switches which will shut down the pump in case of pressure increase over the authorized pressure or sudden pressure loss.

004.03A Appropriate logs and other tests shall be conducted during the drilling and construction of new mineral production wells. A descriptive report interpreting the results of such logs and tests shall be prepared by a qualified log analyst and submitted to the Director. The logs and tests appropriate to each type of mineral production well shall be determined based on the intended function, depth, construction and other characteristics of the well, availability of similar data in the area of the drilling site and the need for additional information that may arise from time to time as the construction of the well progresses. At a minimum, such logs and tests shall include deviation checks conducted on all holes where pilot holes and reaming are used, at sufficiently frequent intervals to assure that vertical avenues for fluid migration in the form of diverging holes are not created during drilling.

005 Specific Requirements for Class V Injection Wells

005.01 All Class V well designs shall be submitted to the Department for approval prior to their construction. Minimum setback distances outlined in this Section are for guidance; the Department will review each Class V well siting on a case-by-case basis.

005.02 Designs for domestic wastewater disposal wells as defined in Chapter 2, 005.17C shall be submitted by a professional engineer and designed, sited and constructed according to Title 124 – Rules and Regulations for the Design, Operation, and Maintenance of On-Site Wastewater Treatment Systems. Minimum setback distances are outlined in Table 17.1 below; a more detailed table of setback distances can be found in Title 124, Chapter 5, Table 5.1.

TABLE 17.1 – Setbacks for Class V Domestic Wastewater Disposal Wells

Receptor	Minimum Setback Distance
Domestic Water Well	100 feet
Community Water Well	1,000 feet
All Other Water Wells	100 feet
Water Lines	25 – 100 feet (depending on type of line)
Property Lines	5 feet
Foundations	10 – 40 feet (depending on type of foundation)
Surface Water	50 feet

005.03 All Class V wells, with the exception of those specified in 005.02 of this Chapter, that are constructed above and do not inject into the uppermost aquifer shall be designed, sited and constructed using the following criteria:

005.03A Wells must be cased with a material that will have the integrity to keep the formation from collapsing for the life of the well and be compatible with the fluid to be injected;

005.03B Wells that have the potential to accept fluids from areas that may generate waste from vehicles (i.e. parking lots) must be equipped with an integral oil/water separator.

005.03C The casing may be open at the bottom or perforated to allow for the injected fluids to be released;

005.03D The surface completion must incorporate a grate or perforated cover to prevent endangerment to persons and/or livestock. The examples illustrated below are only a few variations, other designs may be acceptable;



005.03E The surface completion must be designed to accept only the fluids for which the well is authorized or permitted to accept;

005.03F The total depth of the well must not exceed 20 feet and maintain a minimum separation distance of four (4) feet between the bottom of the casing and the static water level, the seasonal high ground water and/or any confining bed. This four (4) feet separation distance may need to be increased based on the characteristics of the injection fluids;

005.03G All Class V wells that are constructed above and do not inject into the uppermost aquifer with exception of those specified in 005.02 of this Chapter must be sited using the minimum setback distances outlined in Table 17.2 below:

TABLE 17.2 – Setbacks for Class V wells constructed above the water table with the exception of those specified in 005.02

Receptor	Minimum Setback Distance
Domestic Water Well	100 feet
Community Water Well	1,000 feet
Non-community Water Well	500 feet
All Other Water Wells	100 feet
Sewer Lines	25 feet
Pressure Water Lines	25 feet
Suction Water Lines	100 feet
Property Lines	5 feet
Basements/Footings	30 feet
Class V Wells Specified in <u>005.02</u>	100 feet
Class V Wells Specified in <u>005.03</u>	25 feet
Class V Wells Specified in <u>005.04</u>	25 feet
Septic Tanks	50 feet
Surface Water	50 feet

005.04 All Class V wells that inject into or are constructed through the

uppermost aquifer shall be designed, sited and constructed using the following criteria:

005.04A The well shall only inject into one aquifer and be constructed in a manner that does not allow movement of the injected fluids into another aquifer.

005.04B If the well penetrates more than one aquifer, the aquifer(s) being penetrated must be sealed with cement or surface casing in a manner that will not allow the injected fluids to migrate.

005.04C Well casing must be composed of new manufactured material compatible with the fluid to be injected and the formation water in which it is placed,

005.04C1 The well casing must be watertight and be pressure rated using the following formula but no less than 160 pounds per square inch (psi):

$$(((d1 - d2) \times 0.434) + pt) \times 1.20 = \text{minimum pressure rating}$$

d1 = depth of well bore measured from the ground surface in feet

d2 = depth of static water measured from ground surface in feet

pt = total pressure produced by injection activities in psi (i.e. combined head of piping + transfer pump pressure capabilities)

005.04D2 The casing shall be centered in the bore hole in areas of the bentonite seal and cement/bentonite such that there is a uniform annular space of a minimum of two (2) inches in width.

005.04E Wells must utilize a new screen, manufactured with a material compatible with the fluid to be injected,

005.04E1 The screen must be placed a minimum distance below the seasonal low water table to allow for a minimum two (2) foot bentonite seal.

005.04F Prior to placing the bentonite seal, filter pack shall be placed around the screen either manually through the annulus or naturally and allowed to stabilize to a point two and one-half (2.5) times the casing diameter above the screen apertures.

005.04F1 Filter pack shall be designed to prevent the formation materials and the filter pack itself from entering the screen upon development of the well.

005.04G A cement/bentonite grout shall be placed in the annulus after the bentonite seal to a point four (4) feet below the ground surface and consist of a mixture of cement and bentonite in the following proportion:

005.04G1 Seven and one-half (7.5) gallons of fresh water and two and one-half (2.5) pounds of powdered or pulverized bentonite per ninety four (94) pounds of Type II portland cement. No curing additives shall be

added to the grout.

005.04G2 The cement/bentonite grout shall be placed by tremie or by pressure. In no case shall the concrete/bentonite grout be allowed to drop free-fall more than ten (10) feet.

005.04H The well shall be located or the site graded so that surface drainage is away from the well. Surface completions shall be constructed using one of the following:

005.04H1 Connections made below the ground surface must utilize a pitless adapter which must extend at least twelve (12) inches above the ground surface.

005.04H2 Connections made above the ground require a sanitary well cap and a well house over the connections to prevent tampering. The well casing must extend at least twelve (12) inches above the ground surface.

005.04I All Class V wells that inject into or are constructed through the uppermost aquifer must be sited using the minimum setback distances outlined in Table 17.3 below.:

TABLE 17.3 – Setbacks for Class V wells constructed into the water table

Receptor	Minimum Setback Distance
Domestic Water Well	100 feet
Community Water Well	1,000 feet
Non-community Wells	500 feet
All Other Water Wells	25 feet
Sewer Lines	25 feet
Pressure Water Lines	25 feet
Suction Water Lines	50 feet
Property Lines	5 feet
Basements/Footings	10 feet
Class V Wells Specified in <u>005.02</u>	100 feet
Class V Wells Specified in <u>005.03</u>	25 feet
Class V Wells Specified in <u>005.04</u>	25 feet
Septic Tanks	50 feet
Surface Water	50 feet

005.04J Injection fluids shall be placed into the well via drop tubing. The drop tubing shall be selected using the following criteria:

005.04J1 The tubing shall be composed of a manufactured material compatible with the fluid to be injected and the formation water in which it is placed,

005.04J2 The tubing shall be placed into the well through a sanitary seal or pitless adapter.

005.04J3 The tubing must be pressure rated using the formula described in 005.04D1 of this Chapter but with a minimum rating of 160 psi.

005.04J4 The tubing must be open ended (not screened) and must extend a minimum of five (5) feet into the static water in the well.

005.04K A mechanical or inflatable packer may be used in conjunction with the tubing. The packer should be placed no greater than ten (10) feet above the top of the screen.

Enabling Legislation: Neb. Rev. Stat. §§ 81-1504(2)(10)(13); 81-1505(9)(15); 81-1506(e)

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